GEORGIA INSTITUTE OF TECHNOLOGY

PROJECT ADMINISTRATION DATA SHEET

[x] ORIGINAL [ ] REVISION NO. _____

Project No. A-3494 GTRI/~~GIT~~ DATE 3/30/83

Project Director: Phillip L. Williams ~~School~~/Lab EDL/SHD

Sponsor: Centaur Associates, Inc.

Type Agreement: Letter dated 3/8/83

Award Period: From 3/1/83 To ~~4/15/83~~ 4/25/83 (Performance) _____ (Reports)

Sponsor Amount: Total Estimated: $ 6,372.21 Funded: $ 6,372.21

Cost Sharing Amount: $ _____ Cost Sharing No: _____

Title: Technical Support to Analyze the Feasibility of Cotton Seed Oil Mills to Comply with Alternative Dust Levels

ADMINISTRATIVE DATA OCA Contact Faith G. Costello

1) Sponsor Technical Contact:

2) Sponsor Admin/Contractual Matters:

John G. Birdsong, Vice President
Centaur Associates, Inc.
Suite 465
1120 Connecticut Ave., N. W.
Washington, D. C. 20036

Defense Priority Rating: _____

Military Security Classification: _____

(or) Company/Industrial Proprietary: _____

RESTRICTIONS

See Attached N/A Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval – Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of $500 or 125% of approved proposal budget category.

Equipment: Title vests with N/A

COMMENTS:

COPIES TO:

Research Administrative Network
Research Property Management
Accounting
Procurement/EES Supply Services
~~Research Security Services~~
Reports Coordinator (OCA)
GTRI
Library
Research Communications (2)
Project File
Other Williams
Other _____

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION SHEET

Date May 18, 1983

Project Title: Technical Support to Analyze the Feasibility of Cotton Seed Oil Mills to Comply with Alternative Dust Levels

Project No: A-3494

Project Director: Phillip L. Williams

Sponsor: Centaur Associates, Inc.

Effective Termination Date: 4/25/83

Clearance of Accounting Charges: 4/25/83

Grant/Contract Closeout Actions Remaining:

- [x] Final Invoice and Closing Documents
- [ ] Final Fiscal Report
- [ ] Final Report of Inventions
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other _____

Assigned to: EDL/SHD (~~School~~/Laboratory)

COPIES TO:

Administrative Coordinator	Research Security Services	EES Public Relations (2)
Research Property Management	Reports Coordinator (OCA)	Computer Input
Accounting	Legal Services (OCA)	Project File
Procurement/EES Supply Services	Library	Other Williams

FORM OCA 10:781

ENGINEERING EXPERIMENT STATION
Georgia Institute of Technology
A Unit of the University System of Georgia
Atlanta, Georgia 30332

April 22, 1983

Mr. John G. Birdsong
Vice President
Centaur Associates, Inc.
Suite 465
1120 Connecticut Avenue, N.W.
Washington, DC 20036

Dear John:

The final report for the evaluation of the "Feasibility of Cottonseed Oil Mills to Comply with Alternative Dust Levels" is enclosed. Also, attached is a breakdown of the time that Ed and I spent on the project and a copy of my travel expense statement for the Albany trip. If there are any questions, please contact me.

Once again, it was a pleasure to have worked with you and your company. We hope we will have the opportunity again soon.

Sincerely,

Phillip L. Williams
Research Scientist II

PLW:sek

Attachments

BREAKDOWN OF TIME

Ed Hardison

Number of Hours	Date	Work Performed
4	3/1/83	Preparation and Review
3	3/10/83	Preparation and Review
5	3/11/83	Preparation and Review
4	3/14/83	Site Visit Preparation
7	3/15/83	Site Visit
1	3/16/83	Visit Evaluation
4	3/17/83	Visit Review
8	3/18/83	Visit Review
3	3/21/83	Visit Review
2	3/23/83	Visit Review
8	3/24/83	Visit Review
8	3/25/83	Visit Review
8	3/29/83	Meeting w/ J. Birdsong
4	4/8/83	Report Preparation
3	4/11/83	Report Preparation
8	4/19/83	Report Preparation
8	4/20/83	Report Preparation
88		

Phillip L. Williams

Number of Hours	Date	Work Performed
8	3/1/83	Preparation and Review
5	3/7/83	Preparation and Review
5	3/8/83	Preparation and Review
8	3/14/83	Trip to Albany, Georgia
8	3/15/83	Trip to Albany, Georgia
8	3/16/83	Visit Review
8	3/18/83	Visit Review
6	3/25/83	Visit Review
2	3/28/83	Visit Review
8	3/29/83	Meeting w/ J. Birdsong and Report Preparation
6	4/22/83	Report Preparation
72		

(v. 6-76)

UNIVERSITY SYSTEM OF GEORGIA
TRAVEL EXPENSE STATEMENT

№ 70305

TITLE CODE

NAME Williams, Phillip L. (Last / First / Middle Initial) SOC. SEC. NO. 256-90-1435 TITLE Research Scientist II

HEADQUARTERS Atlanta, Ga. INSTITUTION Georgia Tech

RESIDENCE Marietta, Ga. DATE FROM 3/13/83 TO 3/16/83

Day	TIME Departed / Arrived	Location / Points Visited	DETAILS OF SUBSISTENCE (Attach Lodging Receipt) B'fast	Lunch	Dinner	Lodging	TOTAL	Do Not Write in This Space for ACCT. DEPT.
	7:30 am							
3/14	12:15 pm	Albany, GA.		3.55	7.25	25.55	36.35	
	3:50 pm							
3/15	8:30 pm	Albany, GA.	3.75	4.21	6.55		14.51	
		TOTALS	3.75	7.76	13.80	25.55	50.86	

EXPLAIN ANY UNUSUAL AMOUNTS FOR SUBSISTENCE: XXXXXXXX

STATE USE MILEAGE 488 MILES @ 20 CENTS PER MILE (Must be supported by automobile mileage record on reverse side) 97.60

COMMON CARRIER, TAXI/LIMOUSINE (Explain in section on reverse side)

TOTAL TRAVEL EXPENSE 148.46

MISCELLANEOUS EXPENSES (Explain in section on reverse side)

GRAND TOTAL 148.46

I do solemnly swear, under criminal penalty of a felony for false statements subject to punishment by not less than one year nor more than twenty years of penal servitude, that the above statements are true and I have incurred the described expenses and the State use mileage in the discharge of my official duties for the State and have not been reimbursed and have not filed nor will I file for reimbursement from any other source, for said expenses.

APPROVED SIGNED DATE 3/17/83

AUTOMOBILE MILEAGE RECORD

GEORGIA LICENSE NO. OF CAR CEH 163 PERIOD ENDING 3/16/ 1983

Prepare daily, using a separate block for each day's State use travel and for each departure from headquarters.

Day	DAILY TRAVEL (Points Visited)		SPEEDOMETER READING		MILES TRAVELED		
			Starting	Ending	Miles Daily	Personal Use	State Use
3/14	FROM: Marietta Points Visited:	TO: Albany, Ga. (and environs)	29,659	29,903	244		244
3/15	FROM: Albany & Environs Points Visited:	TO: Marietta, Ga.	29,903	30,147	244		244
	FROM: Points Visited:	TO:					
	FROM: Points Visited:	TO:					
	FROM: Points Visited:	TO:					
	FROM: Points Visited:	TO:					
				TOTAL MILES TRAVELED	488		488

Transfer total State use miles to travel expense section (front side) for computation of amount at the prescribed State mileage rate.

PURPOSE OF TRIP: (Attach prior approval form if applicable.)

Consulting work to Contaur Assoc. on Cottonseed Oil Mills

If traveling under a standing authorization please check ☒. A-3494

Day	COMMON CARRIER, TAXI/LIMOUSINE (Explain, attach receipts for common carrier)	Amount	Day	MISCELLANEOUS (Explain, attach receipts except for tele. and telg.)	Amount
	TOTAL AMOUNT (Enter in appropriate line of above expense section)			TOTAL AMOUNT (Enter in appropriate line of above expense section)	

Project A-3494

FEASIBILITY OF COTTONSEED OIL MILLS TO COMPLY WITH ALTERNATIVE DUST LEVELS

Prepared for
Centaur Associates, Inc.
Washington, D.C.

By
Phillip L. Williams, CIH
Research Scientist II
and
Edward H. Hardison III, PE
Research Engineer II

Environmental Health and Safety Division
Engineering Experiment Station
GEORGIA INSTITUTE OF TECHNOLOGY
April 25, 1983

INTRODUCTION

This study has addressed specific questions pertaining to the technical feasibility of cottonseed oil mills to comply with alternative dust levels. Two previous studies - one conducted by Dr. Calvin D. Parnel[1] and another conducted by Dr. Robert M. Bethea, et al[2] - were used as " bench marks."

In the preparation of this report one cottonseed oil mill was visited. It was small in size, processing less than 300 tons of cottonseed per day. The purpose of the visit was not to verify the work of prior investigators but to become more familiar with the process and to attempt to evaluate issues that were not addressed in previous studies.

FEASIBILITY

Various reports have given results of vertical elutriator sampling data from a variety of cottonseed oil mills.[1,2,3] It appears that average concentrations of elutriated dust in each distinct process area of most mills are in excess of the proposed standard of 500 micrograms per cubic meter (ug/m^3). One investigator has proposed that the dust standard may be exceeded by a factor of 2 to 4.[2] The one mill that was visited had reported elutriated dust levels in most areas above the proposed standard. As a result, engineering controls to lower the dust levels will be needed in most if not all the existing cottonseed oil mills.

The ideal way to effectively lower air contaminant levels in an existing operation is to: (1) determine the present airborne air contaminant concentration

and identify the sources; (2) design controls for the sources and prioritize their order of implementation; (3) implement the controls step-by-step with each major change followed by air sampling to determine its effectiveness; and (4) based on the sampling results alter the priority (add or delete unimplemented changes) to achieve the desired air contaminant level.

It can be concluded from the literature that there are few existing dust controls in cottonseed oil mills. This was the situation observed at the one mill that was visited. Consequently, the only available approach is to recommend the best state of the art control technology for existing cottonseed oil mills in hopes that a defined dust level can be reached.

Engineering controls to lower dust levels in cottonseed oil mills have been described by Bethea, et al.[2] The methods described in that report are in accordance with accepted engineering practice and represent current state of the art technology. They would serve as an excellent point from which to begin working towards compliance, following the approach described previously. However, it would be unrealistic to expect that these recommendations will be effective to achieve compliance with the proposed standard. While the design is state of the art, a few areas that need further consideration are discussed.

An area that may not be technically feasible for retroactive dust controls are seed houses that have manually-fed conveyors. It is recognized that a seed house can now be designed to allow for the conveyors to be fed by front-end loaders that are equipped with conditioned cabs. However, some older establishments, such as the mill visited, have a seed house that requires the manual feeding of cottonseed

onto a conveyor. The concrete floor of the building may contain a permanent humidity control system which prevents the use of front-end loaders. This requires an employee to manually feed the conveyor and to have flexibility in movement throughout the seed house. As a result, local exhaust would not be practical and the only control, short of building a new facility, would be personal protective equipment.

During the site visit it was observed that many of the conveyors were located outside. Use of conveyor hoods as discussed by Bethea, et al,[2] in some mill layouts may not be necessary. The amount of dust drawn off the conveyors by such hoods may not justify the expense associated with installation, operation and maintenance of this part of the system.

The effectiveness of the floor sweeps in the bale room is questionable. Instead, a side mounted panel/hood arrangement would collect the dust more effectively in the area.

If other dust standards are considered, for example 1.0 or 0.5 milligrams of total dust per cubic meter of air (as measured with a personal sampler), the feasibility issue becomes even less certain. Parnell[1] reports that in cottonseed oil mills the particle size analyses indicate that the dust contains a high percentage of large diameter dust. This would yield higher total dust concentrations and require additional ventilation controls. The available control technology can possibly allow for compliance with a total dust standard; however, it would require greater volumes of air to be exhausted (increased capture and transport velocities) which would result in greater expenses.

Another problem is caused by exhausting more air. As the velocity of the air is increased, the tendency to pick up larger particles is enhanced and the possibility of product loss (e.g., seeds) increases. However, if sufficient velocity is not maintained, then less dust is captured, which in turn increases the environmental dust level. There will be some product loss at any effort of exhaust ventilation but it will become even greater with a total dust standard. The amount of dirt and trash in this collected waste would prevent it from being recycled as a product.

The more air exhausted, the larger the required filter area, more and/or bigger cyclones will be needed, and larger fans will be required. Due to the relationship of the fan speed and horsepower (horsepower varies as the cube of the fan speed), the fan size will be significantly increased for a small increase in air velocity. The larger equipment is more expensive, requires more energy, and the associated operation costs are higher.

AREA PARTITIONING AND MAKE-UP AIR REQUIREMENTS

The model mill depicted in the report[2] separates the major processing areas. This was undesirable to the personnel at the plant visited because they had less than one employee per area. This required their employees to constantly move from area to area in order to observe and maintain the equipment.

One of the most significant problems that is created in ventilating is the make up air requirement. The make-up air, which must ultimately originate from the ambient outside, may create very uncomfortable working conditions on

extremely cold or hot days. In areas with high ambient dust levels, it may be necessary to prefilter the air, adding to the system costs. During cold or hot days the air may have to be conditioned in order to provide a reasonable working environment for the equipment operators/maintenance personnel. An example of the typical cost for treating the air, which would be required by the model mill depicted in the report, is as follows:

Plant CFM = 93,595 Assume ΔT = 20 average temp. difference e.g. - heating air from 40 to 60° F.

Heat required = 1.08 x 93595 cfm x 20° F.
= 2,021,652 btu/hr ÷ 3414 btu/hr/kw
= 592 kw x 24 hr/day x 7 day/week x 20 week ÷ .40 efficiency
= 4,972,800 kw hrs.

Cost @ $.05/kw hr. = $248,640/heating season

The plant visited did not operate during the summer season; however, for plants that do operate year round, a similar type calculation would be necessary for the summer season.

CLEAN AIR BOOTHS AND CABS

Most job duties of employees of cottonseed oil mills require that they operate and/or monitor machinery throughout a fairly large area. This causes them to be

continually "on the move" and as a result they seldom stay in one area for any length of time. Consequently, the use of clean air booths does not generally seem practical.

The one exception may be the Bale Tender in the waste baling operation of some mills. In this setting the employee may be able to monitor the bale presses from a stationary location for a significant percentage of his/her work time. However, it would be impossible to emphatically state that the time spent in the clean air booth would assure a time-weighted average dust exposure within acceptable limits. This would have to be determined in each individual mill and would require knowledge of the time that would be spent outside the booth and the associated dust levels. Consequently, further dust controls may still be required in the bale press area. The estimated cost of a six foot by eight foot modular clean air booth is $2,400.00.

Cabs for forklifts and front end loaders are technologically feasible. Such cabs usually can be installed on existing equipment and (if properly designed, installed, and maintained) provide a clean air environment for the operator. The estimated cost for a field installed cab is:

Standard 5000 lb forklift -electric	$ 25,300
Standard 5000 lb forklift - electric, with cab (field installed cab)	$ 29,500
Standard 5000 lb forklift - LP gas	$ 20,200
Standard 5000 lb forklift - LP gas, with cab. (field installed cab)	$ 24,300

COST OMISSIONS OF PREVIOUS STUDIES

In addition to the controls recommended in previous reports (Bethea, et al[2]), it is believed that additional controls may be required to achieve compliance with the proposed standard. The principle item would be a local vacuum exhaust system. Presently, it appears that compressed air is used for routine cleaning. Obviously, this procedure does not remove the dust but simply moves it around.

It is believed that compliance with the proposed standard would necesitate to have a vacuum exhaust system similar to the Abington Systems used in cotton yarn mills. The cost of such a system for an average size mill is estimated to be $250,000.

Another item that may be needed to achieve compliance is an automatic baling system. Such a system would provide for the bale press tender to be out of the area the majority of the time and the work in the area could be primarily done at a control panel. The anticipated cost for an automatic baling system is $301,000 for the bale press, $42,715 for a bale handling and packaging unit, and $75,000 for a strapping unit.

The model mill that was desiged by Bethea, et al[2] had abrasive 2nd cut delinters. Based on the results of discussions with the plant personnel and a representative of the National Cotton Council of America, abrasive type delinters are not as commonly used as the saw type delinters. This would have the effect of increasing the ventilation requirements and costs in the delinter room, due to the much more extensive ventilation system required for saw type delinters opposed to

abrasive. The increase in just equipment cost, over that stated in Bethea, et al[2] report, would be:

Air/Cloth = 5:1	Air/Cloth = 10:1	Air/Cloth = 20:1
$528,130	$389,485	$324,690

Of course, the other costs mentioned in the report (power, maintenance, insurance, etc.) would increase proportionately.

One minor item that may lower the projected cost is that as dust is controlled at the beginning of the cottonseed oil mill process, it may result in less dust being generated later in the process. This phenomenon has been observed in cotton yard operations (i.e., dust controlled in opening and carding will automatically account for lower dust levels in roving, drawing, etc...). However, without actual implementation, it is impossible to quantify with any confidence the actual reduction in dust.

PLANT SIZE VARIATIONS (SCALING)

There are some economies of scale which would be realized in the larger plants. It is very difficult to place a percentage on the effect of installing the system at a larger plant, but the larger the plant, the cheaper the system would be on a per ton basis.

As an example, based on the average number of equipments per 100 ton indicated in the Bethea, et al study[(2)], an estimate of the ventilation equipment costs for a 200 ton/day and a 1500 ton/day plant were calculated. These costs were calculated using the Bethea study as the base, and subtracting or adding the

required equipment to satisfy the plant size. Only the equipment which would have a significant change in the order of magnitude of the overall cost were modified. The results of the modification are as follows:

	200 ton/day	500 ton/day	1500 ton/day
A/C 5:1			
Cleaning	169,930	209,600	628,800
Delintering	400,750	917,420	1,937,985
Beater Room	64,105	87,120	261,360
Hulling	166,705	177,295	503,755
Bale Room	291,260	291,260	291,260
Compressor	31,210	31,210	31,210
TOTAL	1,123,960	1,713,905	3,654,370
COST/TON	$5,619/ton	$3,428/ton	$2,436/ton
A/C 10:1			
Cleaning	123,260	150,360	451,080
Delintering	300,835	682,865	1,439,415
Beater Room	53,165	67,995	203,985
Hulling	118,010	128,600	329,080
Bale Room	205,615	205,615	205,615
Compressor	12,055	12,055	12,055
TOTAL	812,940	1,247,490	2,641,230
COST/TON	$4,064/ton	$2,495/ton	$1,760/ton
A/C 20:1			
Cleaning	100,170	120,740	362,220
Delintering	254,150	573,270	1,041,850
Beater Room	47,395	59,025	177,075
Hulling	95,255	105,845	243,335
Bale Room	165,590	165,590	165,590
Compressor	8,120	8,120	8,120
TOTAL	670,680	1,032,590	1,998,190
COST/TON	$3,353/ton	$2,065/ton	$1,332/ton

These estimates indicate that the cost per ton of seed processed decreases as the plant size increases.

REFERENCES

1. Parnell, Calvin D.: "Design and Cost of Lowering Dust Levels in Working Environment of a Typical Cottonseed Oil Mill," Testimony at the informal public hearing at the Occupational Safety and Health Administration Department Auditorium, Washington D.C., April - May 1977.

2. Bethea, Robert; Burford, Charles; Sneed, J.; Kao, J.; and Prosche, Mark: "Description of Model Mill and Proposed Dust Control Technology," report submitted to Science and Education Administration, Southern Regional Research Center, New Orleans, October 1981.

3. Carlson, Mark; Shasby, Michael; Piccirilla, Richard; Engelberg, Alan; Merchant, James; Zey, John; Piacitell, Greg; Petersen, Martin; and Hancock, John: "Respiratory Disorders and Dust Exposure in Sectors of the Cotton Industry of the United States. Part 3: Cottonseed Oil Mills," U. S Department of Health and Human Services, Public Health Service, Centers for Disease Control, Appalachian Laboratory for Occupational Safety and Health, Morgantown, November 1981.